THE ECONOMIC BASE OF THE RED RIVER BASIN ABOVE DENISON DAM

GREAT PLAINS RESOURCE GROUP

NATURAL RESOURCE ECONOMICS DIVISION

ECONOMIC RESEARCH SERVICE

U. S. DEPARTMENT OF AGRICULTURE

24514 THE ECONOMIC BASE

OF THE RED RIVER BASIN

ABOVE DENISON DAM

by

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Working Materials Prepared in this form

for use by Cooperating Agencies

January, 1975

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The uses to which the resources of a basin are put determine the character of its economy. Depending upon resource availability and locational factors, a basin may be expected to specialize in some types of productive activities and to de-emphasize others. The analysis of past and current economic activity in a basin should ascertain those industries in which the basin has tended to specialize as well as those which it has tended to neglect. Such an analysis will serve to identify the uses to which the basin's resources have been put.

Concurrent to the need to identify the industrial uses of basin resources is a need to identify the sources of its economic growth, or lack thereof. In general, the economic growth of a region may be considered as emitting from either of two sources or both. The economic growth of a region may be due to its industry mix or to changes in its regional share of the output of these industries. Growth owing to the industry mix of an area occurs if that area is endowed with rapidly growing industries. Growth owing to the regional share of an area occurs when that area experiences an increase in its relative portion of the total national output of its industries. As the industry mix and regional share components of economic growth occur simultaneously, they may reinforce or offset one another.

The final element of the analysis of the basin economy is the identification of its economic problems. These problems may be detected through a comparison of appropriate statistics describing the basin economy with those of the entire nation. The ultimate manifestation of

most economic problems in any area is substandard living conditions. Poor living conditions, however, are merely symptoms of an unhealthy economy. Before the conomic problems of the Red River Basin can be rectified, it is necessary that they be reduced to their most basic causal elements.

The second major objective of this report is the development of a set of projections of the future course of the basin economy. As the most outstanding characteristic of the future is its uncertainty, the projections made herein are based upon assumed values of the parameters relevant to them. Where appropriate, alternative projections are developed based upon varying parameter values. The resulting projections are considered to be those which have the greatest probability of occurrence based upon the assumed parameter values and currently available information. These projections are intended to reflect the probable economic future of the basin in the absence of programs of resource management and development.

The final objective of this report is to develop an assessment of the impact of programs of resource management and development on the economy of the basin.

The Study Area

The Red River Basin Above Denison Dam extends from Denison Dam on the Oklahoma-Texas boundary westward into Curry and Quay Counties, New Mexico. Some 39,719 square miles (25,420,160 acres) lie within its bounds. The great majority of this area (38,828 square miles) lies in Texas and Oklahoma while only a small fraction (891 square miles) lies in New Mexico.

Elevations range from 600 feet at Denison Dam to approximately 4,800 feet in the headwaters area. The topography of the basin ranges from rolling plains and well defined drainage courses in eastern areas to flat to gently rolling plains with numerous shallow depressions lacking drainage outlets in the west. The climate of the basin ranges from subhumid in the east to semi-arid in the west. Average annual rainfall varies from 39 inches at Denison Dam to 16 inches near the headwaters. Rainfall distribution is erratic throughout the basin both annually and seasonally.

Portions of six land resource areas are contained in the Red River Basin Above Denison Dam. The most predominant of these is the Central Rolling Red Plains which encompasses some 56% of the basin's land area. The Southern High Plains and Central Rolling Red Prairies are the next most predominant land resource areas in the basin. These comprise approximately 17% and 14% of the basin's land area respectively. The Cross Timbers area contains about 7% of the basin's land area while the Grand Prairie area contains some 6%. A small portion of the Texas Blackland Prairie also lies within the basin.

Owing to a lack of data for small areas whose boundaries conform to that of the basin, the area included in this study is not in perfect congruence with the natural basin area. The area of this study, in general, is that of the basin after the basin boundaries have been generalized to conform with county boundaries. Further, the portion of the basin which lies in New Mexico has been excluded. This exclusion was made as a means of bringing the area of study into congruence with Water Resource Subareas 1112 and 1113, the Red River Headwaters and Red-

Washita Subareas respectively. Such a congruence greatly facilitates the use of OBERS projections.

The Red River Headwaters Water Resource Subarea (1112) contains four Texas counties. The Red-Washita Water Resource Subarea (1113) contains 21 Texas and 21 Oklahoma counties. The counties contained by them appear in Table 1.

Water Resource Subareas 1112 and 1113 contain a total of 25,381.4 thousand acres of land area. A preponderance of this area lies within the Red River Basin. Only a small portion lies outside of it. This portion is limited to the parts of counties, having land located within the basin, which lie outside of it. The area of the basin and the area of this study are depicted in Figure 1.

Water Resource Subarea 1112 contains a total land area of 2,693.4 thousand acres all located in Texas. The Amarillo SMSA is located within this subarea.

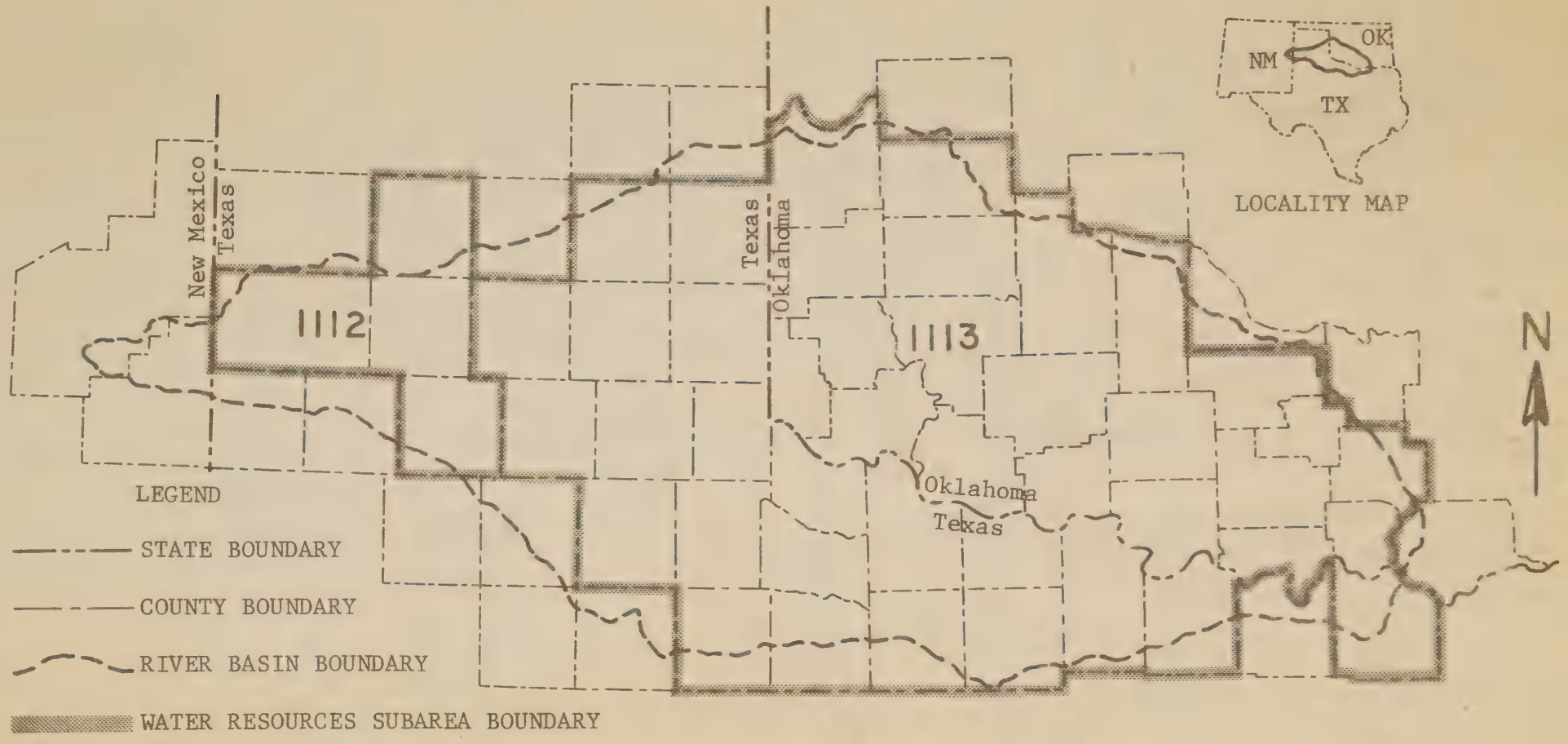
Water Resource Subarea 1113 contains a total land area of 22,688.0 thousand acres. Of this total, 10,943.8 thousand acres are in Oklahoma and 11,744.2 thousand acres are in Texas. Three SMSA's are located in this subarea. These are the Lawton, Oklahoma and Sherman-Denison and Wichita Falls, Texas SMSA's.

The use of Water Resource Subareas 1112 and 1113 as the area of study has important advantages which stem from the location of population and trade centers (SMSA's) within the basin. Three of the basin's four SMSA's are located partially outside the hydrologic boundaries of the basin. In spite of their locations, these SMSA's play important roles in the economy of the basin. To exclude them in whole or in part would not be

Table 1--Counties included in the study area

Water Resource Subarea		Counties
Red River Headwaters (1112)	Texas:	Deaf Smith
		Potter
		Randall
		Swisher
Red-Washita (1113)	Oklahoma:	Beckham
		Caddo
		Carter
		Commanche
		Cotton
		Custer
		Garvin
		Grady
		Greer
		Harmon
		Jackson
		Jefferson
		Johnston
		Kiowa
		Love
		Marshall
		Murray
		Roger Mills
		Stephens
		Tillman
		Washita
	Texas:	Archer
		Armstrong
		Baylor
		Briscoe
		Childress
		Clay
		Collingsworth
		Cottle
		Donley
		Foard
		Gray
		Grayson
		Hall
		Hardeman
		King
		Knox
		Montague
		Motley
		Wheeler
		Wichita
		Wilbarger

Figure 1.
Location of Water Resources Subareas
Red River Basin Above Denison Dam



appropriate to an economic base study of the area. The exclusion of these areas is avoided by adopting Water Resource Subareas 1112 and 1113 as the study area.

The Export Base of the Red River Above Denison Dam

The demand for the resources of a region is determined by the level of economic activity in that region. Changes in resource demand are thus related to the economic growth of the region. The export base theory of regional growth is a conventional postulate of regional economics. The basic supposition of this theory is that regional growth depends upon the growth of its export industries. The growth of export industries, in turn, is assumed to be determined by the fortunes of demand external to the region. Thus, regional growth and the level of regional resource demand is determined not by factors internal to the region but by the demand for regional outputs emanating from outside the region.

The term "export industries", as used here, encompasses those industries which have a net of gross exports to the outside world over gross imports into the region. The existence of net exports has the effect of causing income to flow into the region as payment for the exported goods. This income supports all local economic activity other than export industries. By means of bringing income into a region, export industries serve as the base of the regional economy. They are thus referred to as basic industries. The remaining industries (non-export) are called non-basic or service industries. They comprise the superstructure of the local economy. The term service industries refers to the fact that the demand for the outputs of these industries is derived from the demand for the outputs of basic industries. Non-basic industries exist to serve basic industries.

A number of techniques exist by which basic and non-basic industries may be differentiated. Location quotients were chosen for use in this report. The location quotient is a computation which compares a region's percentage share of a particular activity with its percentage share of a larger aggregate. It reveals the activities in which the region has tended to specialize; that is, the industries which make up its export base. Location quotients are intended only to describe the export structure of the local economy. Basic industries are assumed to have attained that posture as a result of the basin's being endowed with comparative advantages in those industries, but nature of these comparative advantages will not be explored here.

As noted earlier, the location quotient compares the percentage share of an activity within a region with its percentage share of a larger aggregate. In this report, the larger aggregate will be the national economy. Percentage shares will be compared for broad sectors of the basin economy and for industry clusters within the private nonfarm sector. Specifically, the location quotient is the ratio of the percentage share of an activity in a region to the percentage share of that activity nationally. Those activities whose location quotients are greater than 1.0 are considered basic industries. Those for which the location quotient is less than 1.0 are considered non-basic. An activity whose location quotient is 1.0 plays a neutral role in export base theory, and neither brings income into the region nor drains it out as do net import industries.

Regional economic activity can be gauged via a variety of measures. These include employment, income and earnings. The choice of measure should be appropriate to the objective of this analysis which is to assess

the economic base of the Red River Above Denison Dam as it relates to the demand for the basin's resources. Given this objective, it was determined that earnings were the most appropriate measure of economic activity to use in computing location quotients for the basin.

In general, earnings are defined to include all income received by persons in return for contributions to current production. In the regional accounts computed by the Bureau of Economic Analysis, earnings include wages and salaries, other labor income and proprietors' income. Nationally, earnings account for about 80% of the national income.

Earnings were preferred to employment because of the latter measures' failure to sufficiently include those who are self-employed. Continuous employment statistics are least reliable for rural areas owing to weaknesses in the reporting process, especially as applied to agricultural employment. The employment figures published in the Census of Population are more inclusive but are available only on a decennial basis. Such availability prohibits an assessment of the short-run stability of basic/non-basic relationships.

Earnings were chosen over personal income because property income is allocated to the location of property owners and, in many cases, the productive activities in which property resources are employed are found at distinctly different locations than their owners. This applies to both real and intangible property. Personal income statistics, then, do not necessarily reflect economic activity at a particular location, especially for small areas.

Table 2 shows location quotients for total earnings for the broad sectors and industry clusters of the basin economy. These quotients are

given for selected years since 1950 and annually since 1965. The historical quotients were computed as a means of assessing the stability of the export base of the basin economy. The location quotients for 1971 reveal that the export base of the Red River Above Denison Dam was composed of agricultural and mining industries in the private sector and of federal government activity in the public sector.

Farming and related agricultural activities are firmly established in the export base of the regional economy. The location quotient for this industrial cluster has remained well above unity throughout the period 1950-71. The location quotient for this industry was greater in 1971 than in 1950 although not at its peak level for the entire twenty-one year period. The general trend in the value of this quotient has been upward, reflecting an increasing dependence of the economy on agricultural activities.

Mining is the only private nonfarm industry included in the basin's export base. The location quotient for this industry has also remained consistently well above unity over the period 1950-71. The value of the location quotient for this industry, however, was lower in both 1970 and 1971 than in any other year during the period covered. These relatively low quotients probably reflect the increased regulation of activity to conserve supplies in this industry which took place about 1970 and 1971. Mining activity in the basin is primarily of the energy and related type. Recent supply and price developments in the energy industry suggest that activity in this industry will be increasing. Within the basin, the increase in activity will probably take the form of not only an increase in the value of production but also an increase in exploration efforts

Table 2
Location Quotients for Total Earnings
Red River Basin Above Denison Dam
1950-1971

Industrial Source of Earnings	Year									
	1950	1959	1962	1965	1966	1967	1968	1969	1970	1971
Farm	2.74	3.12	2.96	3.61	3.43	3.36	3.34	3.42	3.98	3.44
Nonfarm	.83	.90	.91	.89	.90	.91	.92	.92	.90	.92
Government	1.59	1.83	1.84	1.77	1.97	2.00	1.93	1.83	1.70	1.65
Federal	2.23	2.81	2.97	2.88	3.38	3.44	3.32	3.12	2.84	2.76
State & Local	.92	.94	.92	.94	.90	.90	.90	.90	.89	.92
Private Nonfarm	.73	.74	.65	.72	.68	.69	.71	.72	.73	.76
Manufacturing	.24	.07	.29	.29	.28	.30	.30	.36	.42	.45
Mining	3.32	4.30	4.86	4.15	3.79	4.12	3.84	3.46	2.39	2.58
Contract Construction	.85	.88	.84	.69	.67	.67	.68	.69	.66	.63
Transportation, Communication & Public Utilities	.88	.98	.91	.93	.88	.87	.88	.86	.84	.87
Wholesale & Retail Trade	1.01	.98	.99	.99	.95	.93	.94	.94	.95	.97
Finance, Insurance & Real Estate	.56	.67	.68	.74	.71	.69	.68	.67	.62	.66
Services	.84	.81	.80	.82	.79	.80	.82	.83	.83	.84
Other	.85	1.26	1.22	1.55	1.47	1.34	1.32	1.27	1.14	.76

and the revitalization of previously marginal operations. It seems reasonable to conclude that the mining industry will continue to comprise a portion of the basin's export base.

Although governmental activity behaves quite unlike its private sector counterpart, it can be analyzed spatially in much the same manner. Like private sector activity, that of governments tends not to be ubiquitous in space but to be concentrated at a few locations. At those locations, government activity takes on much the same character as a private sector industry insofar as basic/non-basic relationships are concerned. Regionally, income inflows occur in response to the export of government services. This has been the case for the Red River Basin Above Denison Dam insofar as federal government activity is concerned.

The location quotient for federal government earnings has been substantially above 1.0 throughout the period covered 1950-71. These relatively high quotients are primarily the result of substantial military installations within the basin. Since 1967, the location quotient for federal government activity has tended generally lower. This decline corresponds to a decline in the level of military activity within the basin. As the level and location of governmental activity is determined primarily by political rather than economic considerations, no attempt will be made here to assess the future stability of the federal sector as a component of the basin's export base.

Basic/non-basic relationships can be expected to vary somewhat within the basin. Such variation is due to the size and spatial diversity of the basin economy and can be detected by computing the same location quotients for subareas within the basin as are given in Table 2 for the

entire basin. Tables 3, 4 and 5 depict these quotients for W.R.S. 1112, and separately for the Texas and Oklahoma portions of W.R.S. 1113. A comparison of the location quotients for these subareas will reveal the extent to which basic/non-basic relationships vary within the basin.

Agriculture is the one basic industry common to all subareas within the basin with location quotients substantially above 1.0. Federal government activity is a component of the export bases of both Oklahoma and Texas portions of W.R.S. 1113. Federal government activity has been non-basic to the economy of W.R.S. 1112 since 1968 although it had been basic for some time prior to and including 1968. In addition, W.R.S. 1112 differs from other subareas in the basin insofar as wholesale and retail trade activities are included in its export base. This reflects the role of the Amarillo SMSA as a regional distribution center.

The reader will note that Tables 3 through 5 do not reflect the role of mining activity as a basic industry within the basin's subareas. This is due to disclosure problems involved in publishing data at this level of aggregation. It is probably safe to assume, however, that mining is a basic activity in all basin subareas in spite of these problems.

Export Earnings in Relation to Total Basin Earnings

Export base theory emphasizes the role of export activities in fueling regional growth. The previous section reported the results of using location quotients to identify industries which comprise the export base of the basin economy. The purpose of this portion of the report is to ascertain the relationship between export activity and the level of total economic activity in the basin.

Table 3
Location Quotients for Total Earnings
Water Resource Subarea 1112
1950-1971

Industrial Source of Earnings	Year									
	1950	1959	1962	1965	1966	1967	1968	1969	1970	1971
Farm	2.21	3.06	2.89	3.27	3.31	3.14	3.26	3.18	3.41	2.75
Nonfarm	.88	.90	.91	.90	.90	.92	.93	.93	.92	.94
Government	.56	1.40	1.59	1.49	1.84	1.66	1.35	.85	.80	.80
Federal	.42	2.08	2.55	2.33	3.22	2.75	1.97	.69	.63	.64
State & Local	.71	.78	.79	.85	.77	.83	.90	.97	.91	.91
Private Nonfarm	.93	.82	.78	.79	.72	.77	.83	.94	.95	.98
Manufacturing	.31	.20	.20	.24	.22	.24	.27	.38	(D)	.46
Mining	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Contract Construction	1.29	1.02	.95	.79	.73	.89	.86	.88	.86	.87
Transportation, Communication & Public Utilities	1.26	1.41	1.35	1.39	1.25	1.29	1.41	1.50	1.45	1.50
Wholesale & Retail Trade	1.49	1.27	1.26	1.26	1.16	1.18	1.28	1.43	1.42	1.44
Finance, Insurance & Real Estate	.73	.97	.94	1.02	.93	.98	1.05	1.11	(D)	.96
Services	.95	.90	.89	.91	.84	.91	1.01	1.13	1.13	1.11
Other	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	.66	(D)

(D)- Withheld to avoid disclosure

Source: Bureau of Economic Analysis, U. S. Department of Commerce.

Table 4
Location Quotients for Total Earnings
Water Resource Subarea 1113-Oklahoma Portion
1950-1971

Industrial Source of Earnings	Year									
	1950	1959	1962	1965	1966	1967	1968	1969	1970	1971
Farm	2.87	3.36	3.01	4.34	3.86	3.94	3.47	3.86	4.62	3.79
Nonfarm	.82	.89	.91	.86	.88	.89	.92	.90	.88	.91
Government	1.77	2.33	2.23	2.18	2.33	2.48	2.45	2.40	2.22	2.15
Federal	2.41	3.74	3.70	3.77	4.08	4.50	4.50	4.47	4.15	3.98
State & Local	1.10	1.03	1.03	.99	.98	.93	.93	.91	.90	.95
Private Nonfarm	.69	.64	.65	.60	.59	.57	.59	.59	.58	.63
Manufacturing	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Mining	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Contract Construction	.94	.85	.88	.61	.59	.50	.59	.60	.56	(D)
Transportation, Communication & Public Utilities	.56	.71	.65	.68	.67	.61	(D)	.63	(D)	(D)
Wholesale & Retail Trade	1.04	.82	.85	.81	.81	.75	.77	.74	.73	.78
Finance, Insurance & Real Estate	.57	.53	.54	.56	.56	.52	(D)	(D)	(D)	(D)
Services	.86	.67	.69	.68	.67	.66	.69	.66	.65	.69
Other	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)

(D)- Withheld to avoid disclosure

Source: Bureau of Economic Analysis, U. S. Department of Commerce.

Table 5
Location Quotients for Total Earnings
Water Resource Subarea 1113-Texas Portion
1950-1971

Industrial Source of Earnings	Year									
	1950	1959	1962	1965	1966	1967	1968	1969	1970	1971
Farm	2.85	2.90	2.97	3.00	3.05	2.81	3.24	3.06	3.55	3.43
Nonfarm	.82	.91	.91	.92	.91	.93	.93	.93	.92	.92
Government	1.88	1.55	1.60	1.48	1.68	1.65	1.67	1.70	1.56	1.56
Federal	2.83	2.23	2.45	2.19	2.70	2.64	2.74	2.86	2.55	2.59
State & Local	.88	.94	.89	.96	.89	.91	.88	.86	.87	.89
Private Nonfarm	.67	.80	.78	.80	.76	.78	.77	.77	.77	.78
Manufacturing	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Mining	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Contract Construction	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Transportation, Communication & Public Utilities	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Wholesale & Retail Trade	.80	.97	.96	1.02	.97	.97	.95	.92	.94	.93
Finance, Insurance & Real Estate	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Services	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)
Other	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)	(D)

(D)- Withheld to avoid disclosure

Source: Bureau of Economic Analysis, U. S. Department of Commerce.

Earnings have been used in this report to measure economic activity in the basin. This measure will also be used to gauge the relationship between the level of export activity and total economic activity in the basin. Earnings derived from export activity may be estimated by subtracting from total earnings the proportion of total earnings which is due to the local consumption of output. This operation is carried out for those sectors or industries which are found to be basic to the regional economy. The proportion of total earnings derived from the export of industry output may be estimated as the ratio of the difference between one and the value of the location quotient for the industry in question to the value of the industry location quotient itself. This proportion is then multiplied by the total earnings of the industry in question. The product is an estimate of earnings derived from export activities in that industry and are shown for the study area in Table 6.

Earnings derived from agricultural exports are by far the greatest private sector source of export earnings in the basin. In 1971, these earnings approximated $189.4 million but were considerably less than the previous year's level of $234.5 million. The latter level of export earnings, however, appears to have been exceptional for the basin, at least for the years covered by the table. The general trend in the basin's level of export earnings from agriculture, however, has been upward. Export earnings from this industry have probably exceeded their previous peak in the years since 1971.

The largest source of export earnings in the basin is federal government activity amounting to $314.2 million in 1971. The level of federal export earnings in the basin has declined annually since 1968

Table 6
Estimated Earnings Due to Export Activities
Red River Basin Above Denison Dam
1950-1971

Industry	1950	1959	1962	1965	1966	1967	1968	1969	1970	1971
	Export Earnings in Thousands of Current Dollars									
Farm	140,500	133,000	135,800	183,500	191,600	169,800	165,500	186,300	234,500	189,400
Federal Government	65,700	170,100	212,100	217,700	324,200	362,500	365,900	347,900	326,600	314,200
Mining	42,700	67,300	76,000	61,900	59,500	68,700	63,400	55,300	34,200	38,200
Total Export Earnings	248,990	370,400	423,900	463,100	575,300	601,000	594,800	589,500	595,300	541,800
Total Basin Earnings	920,330	1,399,080	1,570,138	1,734,202	1,964,622	2,066,985	2,180,507	2,315,204	2,457,621	2,494,857
Export Earnings as a Percent of Total Earnings	27	26	27	27	29	29	27	25	24	22

after peaking at $365.9 million in that year. This decline has been due largely to a decline in military and related activity in the basin.

Export earnings resulting from mining activity in the basin are estimated at $38.2 million for 1971. Although higher than the estimate for the previous year, they were approximately 56 percent of their 1967 level. The probable reasons for this decline were discussed in the previous section. As was noted there, total mining activity in the basin has probably increased since 1971 and will probably continue to do so, at least in the near future.

Total earnings from export activity in the basin were $541.8 million in 1971. This figure was down considerably from its level of $595.3 million in the previous year and also the lowest since 1966. This condition resulted primarily from substantial declines in mining and federal govennment activity since 1967-68 and the failure of sufficient agricultural export growth to compensate for these declines.

In a regional economy the industrial structure of the basic/non-basic relationship may be stable or unstable as well as the relative magnitude of basic to non-basic activity. We have previously noted that the industrial structure of the basic/non-basic relationship of the basin economy has been relatively stable historically. We now need to assess the stability of the relationship between basic and non-basic activities. Relative stability is essential to the confidence which can be placed in estimates of the impact of future resource development projects on the basin economy.

The relationship between the magnitude of export activities to that of total economic activity may be brought out by constructing ratios of the former to the latter. Such ratios are sensitive to relative changes in the magnitudes of these activities. They also serve to reveal the size of the basin's export base relative to the total dimensions of the basin economy. This is analogous to comparing the foundation of the basin economy to its superstructure.

In 1971, export earnings were 22 percent of the total earnings of the basin economy. This is the lowest level of the export relative for the period covered by the table. The basin's export relative has declined steadily since 1967 after having reached a peak level in that and the preceeding year. Prior to these years, basin export earnings as a percent of total earnings had remained constant at 27 percent except for a decline to 26 percent in 1959.

At least two explanations can be offered for the decline in the basin's export relative. One is that the growth of the residentiary sector of the basin economy has been slow to respond to declines in export activity. The second is that the residentiary sector is becoming more developed, at least in the sense of being more self-sufficient.

The first explanation of the basin's declining export relative is easily discounted. This is not to say that the response of non-basic industries to changes in the level of basic activity is not lagged. It is simply to say that the data contained in Table 6 does not support this as a sole explanation for the behavior of the export earning relative since 1966-67. Over this period, earnings from export activities

have been stable if not declining. Over the same period, total basin earnings have been increasing. This suggests that non-basic earnings have recently been rather independent of basic earnings at least in their magnitude. This independence may be a short-run phenomenon. It suggests that the basin's basic and non-basic activities are not stable in their relative magnitudes and that the source of this instability is something other than the lagged response of non-basic activity.

The explanation of the basin's declining export relative in terms of the development of the non-basic sector is more acceptable. This means that the residentiary sector has reached a size sufficient to support locally certain activities which had previously been imported. In effect, it can be argued that the scale of the market within the basin has attained a size sufficient to warrant the location of non-basic activities within it where previously they had been located elsewhere and their products imported. As the size of the local market reached a certain level, it became more profitable for the production of some outputs sold within the basin to be located there rather than elsewhere and transported into the basin. Such market orientation is largely a function of the scale of the market. The attainment of such a market scale constitutes a benefit to consumers as well as producers. It is particularly evident in the behavior of the location quotients for manufacturing and trade activities since 1967. It is conceivable that, at some point, market scale becomes a diseconomy due to congestion. Given the current density of settlement in the basin, however, it is doubtful that this will become a problem in the foreseeable future.

The effect of the development of the non-basic sector of the basin economy is to enlarge the superstructure of the basin economy relative

to its foundation. With this enlargement, future changes in the level of basic activity can be expected to have greater impacts on the basin economy than in the past. The extent of these impacts will be dealt with in a latter section of this report.

Sources of Economic Growth In The Basin

Economic growth in the United States has not been uniform geographically. The economic growth of some regions has been quite rapid, in others, it has been slow. The result of such differential growth patterns has been a substantial geographic redistribution of economic activity. Rapidly growing regions increase their share of national economic activity. Those which grow more slowly experience a decline in their share of total activity. The purpose of this section is to analyze the experience of the Red River Basin Above Denison Dam in this respect.

The overall pattern of regional growth may be assessed by considering it to be of three general types. Regional growth may be due to national growth, to regional industry mix, or to changes in the regional share of national output.

National growth provides the basis for analyzing regional growth. The growth rate of a regional economy, or of particular sectors and industries, may be classified as rapid if it exceeds the national rate and slow if it falls short of the national rate. In many cases, regional or industry growth is due entirely to national growth. In these cases, the regional or industry growth rate is equal to or less than the national growth rate and results entirely from national economic expansion.

Growth owing to industry mix occurs when the regional distribution of industries is such that rapidly growing industries are more frequent

than slowly growing industries. As in the case of national growth, the rapidity of industry growth is measured against the national growth rate for all industries. A regional industry mix is characterized as rapid growth if it is dominated by industries which are growing faster than the national growth rate. A regional industry mix is classified as slow-growth if it is dominated by industries growing slower than the overall national growth rate.

Growth owing to changes in the regional share of national activity by industry is the third general type of economic growth to be considered here. A region experiences growth of this type when on the average for all its industries, its share of national activity increases. Growth of the regional share variety cannot be experienced by all regions simultaneously. When one region increases its share of national economic activity, at least one other region must experience a decline in its share of total activity.

Table 7 depicts the components of economic growth in the Red River Basin Above Denison Dam from 1940 to 1950 and 1950 to 1960. The unit of measure in this table is employment. Data are given for the entire basin and for water resource subareas.

During the decade 1940-1950, employment in the basin increased by 61,766 workers. The magnitude of this increase is less than the influence of national growth. Had the basin economy grown at the rate of national economic expansion, employment would have increased by 68,769. The shortfall was due to the slow-growth industry mix of the basin during this decade. This component of growth detracted from the expansion of the basin economy in the amount of -20,189 jobs. During the same decade, the regional share component contributed 13,186 new jobs to the economy of the basin.

Table 7
Components of Economic Growth
Red River Basin Above Denison Dam
1940-1960
(Measured in terms of employment)

	1940-1950			Total	1950-1960			Total
	Changes Related To-			Change	Changes Related To-			Change
	National Growth	Industry Mix	Regional Share		National Growth	Industry Mix	Regional Share	
W.R.S. 1112	7,353	768	7,522	15,643	6,688	-412	22,896	29,172
W.R.S. 1113-Oklahoma	34,042	-10,737	-9,025	14,280	21,957	-11,751	4,915	15,121
W.R.S. 1113-Texas	27,374	-10,220	14,689	31,843	20,794	-1,908	-19,852	-966
Total W.R.S. 1113	61,416	-20,957	5,664	46,123	42,751	-13,659	-14,937	14,155
Total Red River Above Denison Dam	68,769	-20,189	13,186	61,766	49,439	-14,071	7,959	43,327

Source: Computed from Growth Patterns in Employment By County, 1940-1950 and 1950-1960, Vol. 6 Southwest, U.S. Department of Commerce, Office of Business Economics, 1965.

Basin employment increased by 43,327 during the decade 1950-1960. This increase was also less than that which would have ensued had the basin economy expanded at the national rate (49,439). As with the previous decade, the retarded growth was due to the slow-growth industry mix of the basin economy. This component of growth detracted from the basin's economic expansion in the amount of -14,071 jobs. For the entire basin, the regional share component was favorable during the 1950-1960 decade as well as from 1940-1950, creating 7,959 new jobs from 1950 to 1960.

Economic growth within the basin has not been geographically uniform over the decades under consideration. This fact may be revealed by a brief review of the growth experience of the water resource subareas which comprise the basin.

Water Resource Subarea 1112 enjoyed the most consistently favorable growth over the two decades from 1940 to 1960. In both decades, actual growth exceeded growth due to national economic expansion. This was due primarily to significant increases in this subarea's regional share of total activity. The influence of the industry mix of this subarea was positive (768 new jobs) from 1940 to 1950, but negative (-412) from 1950 to 1960.

The pattern of economic expansion has been diverse within W.R.S. 1113. The growth experience of the Oklahoma portion of this subarea has been the second most favorable of the three subareas in the basin but has not been consistent. In both the 1940-1950 and 1950-1960 decades, growth in this subarea fell considerably short of the rate of national economic expansion. From 1940 to 1950 this shortfall was due both to a

slow-growth industry mix and to a decline in the subarea's share of total output. The shortfall for the decade from 1950 to 1960 was due entirely to a continued poor industry mix. The regional share component of growth was favorable during this decade.

The Texas portion of W.R.S. 1113 had drastically different growth experiences during the two decades in question. Economic growth in this subarea exceeded the national rate of growth during the decade 1940 to 1950. This growth was due to an expanding regional share of total output which contributed 14,689 jobs to the employment growth of the subarea. The industry mix of the subarea exerted a negative influence on its economic growth over this period. The growth experience of the Texas portion of W.R.S. 1113 changed dramatically during the decade from 1950 to 1960. Employment in this subarea was 966 less in 1960 than in 1950. The major contributor to this decline was a severe drop in the subarea's regional share of total output which registered a decline of -19,852 jobs. The industry mix of the subarea was responsible for an additional decline of -1,908 jobs over the same period. The combined influence of these negative growth components outweighed the positive influence of national growth (20,794) over the decade resulting in the decline in employment.

Table 8 gives a detailed analysis of the components of growth by subarea, sector and broad industry groups for the basin over the years from 1959 to 1970. The unit of measure in this table is earnings expressed in millions of current dollars. The final portion of the table is a summary presentation of the analysis for the entire basin.

From 1959 to 1970, total basin income increased by $1,024.1 million. All of this increase was due to national economic expansion. Both the

Table 8
Components of Change in Earnings by Sector and Industry, 1959-1970
Red River Basin Above Denison Dam

Sector and Industry	Earnings		Total Change	Changes Related To:		
	1959	1970		National Growth	Industrial Mix	Regional Share
	Millions of Current Dollars					
W.R.S. 1112						
Farm	43.8	53.8	10.0	44.6	-25.4	-9.2
Nonfarm	275.7	434.4	158.7	281.3	7.7	-130.3
Government	63.2	69.1	5.9	64.5	21.3	-79.9
Federal	44.9	22.3	-22.6	45.8	5.8	-74.2
State and Local	18.3	46.8	28.5	18.7	15.5	-5.7
Private Nonfarm	212.5	365.3	152.8	216.8	-13.6	-50.4
Manufacturing	19.3	56.2	36.9	19.8	-3.4	20.5
Mining	12.9	9.7	-3.2	13.2	-8.0	-8.4
Contract Construction	20.0	26.0	6.0	20.4	-0.2	-14.2
Trans., Comm. & Public Util.	34.8	50.6	15.8	35.5	-5.5	-14.2
Trade	72.6	115.8	43.2	74.1	-10.8	-20.1
Fin., Ins. & Real Estate	15.8	21.6	5.8	16.1	0.3	-10.6
Services	36.8	84.5	47.7	37.4	14.0	-3.7
Other	0.3	0.9	0.6	0.3	0.0	0.3
Total W.R.S. 1112	319.5	488.2	168.7	325.9	-17.7	-139.5
W.R.S. 1113-Texas						
Farm	66.1	105.0	38.9	67.5	-38.3	9.8
Nonfarm	435.0	789.3	354.2	444.0	9.4	-99.2
Government	111.8	253.7	141.9	114.0	39.8	-11.9
Federal	76.7	169.7	93.0	78.2	10.1	4.7
State and Local	35.1	84.0	48.9	35.8	29.7	-16.6
Private Nonfarm	323.2	535.6	212.3	330.0	-30.4	-87.3
Manufacturing	52.9	128.7	75.8	54.1	-8.5	30.2
Mining	39.6	16.9	-22.7	40.4	-24.6	-38.5
Contract Construction	26.1	38.6	12.5	26.6	-0.3	-13.8
Trans., Comm. & Public Util.	40.2	54.1	13.8	41.1	-6.4	-20.9
Trade	88.3	144.2	55.9	90.1	-13.1	-21.1
Fin., Ins. & Real Estate	16.7	30.5	13.8	17.0	0.3	-3.5
Services	58.6	121.5	62.9	59.8	22.3	-19.2
Other	0.8	1.1	.3	0.9	-0.1	-0.5
Total W.R.S. 1113-Texas	501.1	894.3	393.1	511.5	-28.9	-89.4

Table 8

Components of Change in Earnings by Sector and Industry, 1959-1970

Red River Basin Above Denison Dam

Sector and Industry	Earnings		Total Change	Changes Related To:		
	1959	1970		National Growth	Industrial Mix	Regional Share
	Millions of Current Dollars					
W.R.S. 1113-Oklahoma						
Farm	85.8	153.9	68.1	87.6	-49.7	30.2
Nonfarm	482.0	876.2	394.2	491.9	27.0	-124.7
Government	187.3	408.7	221.4	191.3	55.5	-25.4
Federal	144.2	310.3	166.1	147.2	18.9	0.0
State and Local	43.1	98.4	55.3	44.1	36.6	-25.4
Private Nonfarm	294.7	467.5	172.8	300.6	-28.5	-99.3
Manufacturing	47.1	99.1	52.0	48.1	-7.4	11.3
Mining	34.8	32.3	-2.5	35.4	-21.5	-16.4
Contract Construction	29.8	35.6	5.8	30.5	-0.3	-24.4
Trans., Comm. & Public Util.	31.0	41.8	10.8	31.5	-4.9	-15.8
Trade	83.9	125.0	41.1	85.6	-12.6	-31.9
Fin., Ins. & Real Estate	15.4	25.7	10.3	15.7	0.3	-5.7
Services	48.4	101.8	53.4	49.4	18.5	-14.5
Other	4.3	6.2	1.9	4.4	-0.6	-1.9
Total W.R.S. 1113-Oklahoma	567.8	1,030.1	462.3	579.5	-22.7	-94.5
Basin Totals						
Farm	195.7	312.7	117.0	199.7	-113.4	30.8
Nonfarm	1,192.7	1,377.6	907.1	1,217.2	44.1	-354.2
Government	362.3	731.5	369.2	369.8	116.6	-117.2
Federal	264.8	502.3	236.5	271.2	34.8	-69.5
State and Local	97.5	229.2	132.7	98.6	81.8	-47.7
Private Nonfarm	830.4	1,368.4	537.9	847.4	-72.5	-237.0
Manufacturing	119.3	284.0	164.7	122.0	-19.3	62.0
Mining	87.3	58.9	-28.4	89.0	-54.1	-63.3
Contract Construction	75.9	100.2	24.3	77.5	-0.8	-52.4
Trans., Comm. & Public Util.	106.0	146.5	40.4	108.1	-16.8	-50.9
Trade	244.8	385.0	140.2	249.8	-36.5	-73.1
Fin., Ins. & Real Estate	47.9	77.8	29.9	48.8	0.9	-19.8
Services	143.8	307.8	164.0	146.6	54.8	-37.4
Other	5.4	8.2	2.8	5.6	-0.7	-2.1
Total - Red River Above Denison Dam	1,388.4	2,412.6	1,024.1	1,416.9	-69.3	-323.4

Note: Components may not sum to totals due to rounding. Private nonfarm components do not sum to their respective totals due to incomplete data.

industry mix and regional share components detracted from regional growth over this period. The industry mix component contributed $-69.3 million to this detraction while the regional share component contributed a more notable $-323.4 million. The detail of Table 8 allows for the identification of the sectors and industries responsible for these declines.

The negative influence of the industry mix component stems from the dependence of the basin economy on slow-growth industries. Chief among these industries is agriculture. Agriculture has been a slow-growth industry for several decades. Area economies in which agriculture plays an important role can thus expect this dependence to retard their overall economic growth. The extent of this retardation for the regional economy of the Red River Basin Above Denison Dam was $-113.4 million over the period 1959-1970. Nonagricultural industries which also have contributed to the negative influence of the industrial mix component are: manufacturing, mining, transportation, communication and public utilities, and trade.

The failure of the basin economy to expand at the national rate is most evident in the behavior of the regional share component of its growth. The industrial incidence of this component is reflected in Table 8. This table reveals that the only industries in which the basin's share of national activity has increased are agriculture and manufacturing. It is important to note that these industries were slow-growth industries over the period in question. The economy of the basin has experienced declines in its regional share of such rapid-growth industries as services and government.

The growth experiences of the three subareas within the basin were much more consistent from 1959 to 1970 than in the previous two decades.

Although minor variations in growth patterns between subareas exist for the 1959-70 period, these variations are not sufficient to warrant discussion. For the subareas as well as the basin, the slow growth record from 1959 to 1970 was due to a slow-growth industry mix and to a generally declining regional share of national activity.

The economic growth experience of the basin over the last thirty years may be summarized as follows. Almost all of the basin's economic growth has been due to national expansion. An expanding share of national activity helped to bolster growth from 1940 to 1960. Since 1960, however, the regional share component has been the primary deterrent in the growth process. The basin's industry mix was chiefly responsible for its retarded growth from 1940 to 1960. Although this component continues to dampen regional economic growth, its negative influence has lessened in recent years.

Projected Levels of Economic Activity in the Basin

Resource demand is derived from the demand for the final outputs which those resources are used to produce. In an open regional economy, the demand for regional output arises not only from within the region but also from those areas which trade with the region. These areas include the rest of the United States through domestic trade and the rest of the world through international trade.

To be useful in resource studies, projections of regional economic activity must be made in the context of national and international activity levels. OBERS projections[1/] are made in this context. These are projections

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1/ Projections of population, personal income, employment, earnings and output resulting from a coordinated projection program of the Bureau of Economic Analysis, U. S. Department of Commerce and the Economic Research Service, U. S. Department of Agriculture.

of economic activity for the United States, individual states, economic areas, water resource regions and subareas. Regional projections contained in OBERS are consistent with national projections and implicitly reflect international trade. They are also specific as to the projected demand for the outputs of individual industries.

The availability of the OBERS projections provides a basis for the consideration of the economic future of Red River Basin Above Denison Dam. In this report, the OBERS projections for the basin will be presented and then assessed as to their reasonableness. The assessment of their reasonableness will be carried out by comparing the human resources necessary to support the basin's activity levels as projected by OBERS with independently projected availability of human resources in the basin. In effect, the OBERS projections for the basin will be assessed by comparing the demand for one factor of production implicit in those projections with the independently projected supply of the same factor. As there are presently no feasible means available to assess capital and entrepreneurial resources regionally, these factors of production will be ignored. The assessment of the basin's land and water resources will not be considered here, but will be considered in depth in other phases of the river basin study.

Table 9 gives the projected levels of total earnings by industry for the Red River Basin Above Denison Dam Study Area as published in the 1972 OBERS. Location quotients have been computed for each industry as a means of extending the base analysis through the projection period. Table 10 gives the same information as published in the 1974 OBERS studies.

Table 9

1972 OBERS Projections of Earnings by Industry

Red River Above Denison Dam Study Area

1967-2020

Industry		Year							
		1967		1980		2000		2020	
		Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.
Total Earnings	W.R.S. 1112	476.8	1.0	569.2	1.0	1,005.3	1.0	2,028.3	1.0
	W.R.S. 1113	1,590.2	1.0	2,428.7	1.0	4,845.4	1.0	9,926.4	1.0
	Basin Total	2,067.0	1.0	2,997.9	1.0	5,850.7	1.0	11,954.7	1.0
Farm	W.R.S. 1112	52.3	3.14	53.2	4.16	66.4	5.12	116.3	5.62
	W.R.S. 1113	190.2	3.94	189.5	3.47	222.1	3.55	388.4	3.83
	Basin Total	242.5	3.36	242.7	3.60	288.5	3.82	504.7	4.14
Government	W.R.S. 1112	131.1	1.66	120.4	1.13	227.0	1.10	459.5	1.05
	W.R.S. 1113	555.0	2.48	889.4	1.95	1,818.7	1.82	3,619.3	1.70
	Basin Total	686.1	2.00	1,009.8	1.78	2,045.7	1.70	4,078.8	1.59
Manufacturing	W.R.S. 1112	34.1	.24	51.0	.33	89.9	.36	178.9	.38
	W.R.S. 1113	(D)	(D)	297.5	.45	655.8	.54	1,465.4	.60
	Basin Total	181.9	.30	348.5	.42	745.7	.51	1,644.3	.59
Mining	W.R.S. 1112	(D)	(D)	12.6	2.66	16.8	3.09	21.2	2.84
	W.R.S. 1113	(D)	(D)	89.6	4.45	113.5	4.33	142.1	3.86
	Basin Total	90.3	4.12	102.2	4.11	130.3	4.13	163.3	3.70
Contract Construction	W.R.S. 1112	25.0	.89	26.6	.78	46.0	.77	92.6	.77
	W.R.S. 1113	57.5	.50	101.7	.70	216.5	.75	461.8	.79
	Basin Total	82.5	.67	128.3	.72	262.5	.76	554.4	.78

(continued)

Table 9
1972 OBERS Projections of Earnings by Industry
Red River Above Denison Dam Study Area
1967-2020

Industry		Year							
		1967		1980		2000		2020	
		Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.
Transportation, Communication & Public Utilities	W.R.S. 1112	42.7	1.29	55.8	1.52	94.1	1.58	174.9	1.55
	W.R.S. 1113	82.2	.61	121.2	.78	237.6	.83	478.3	.86
	Basin Total	124.9	.89	177.0	.91	331.7	.96	653.2	.98
Wholesale & Retail Trade	W.R.S. 1112	93.4	1.18	122.6	1.28	212.9	1.24	429.6	1.23
	W.R.S. 1113	225.4	.75	351.5	.86	710.8	.86	1,456.4	.85
	Basin Total	318.8	.93	474.1	.94	923.7	.93	1,886.0	.92
Finance, Insurance & Real Estate	W.R.S. 1112	24.0	.98	31.8	1.09	57.5	1.15	119.4	1.20
	W.R.S. 1113	49.3	.52	76.4	.68	153.6	.64	313.8	.65
	Basin Total	73.3	.69	108.2	.71	211.1	.73	433.2	.74
Services	W.R.S. 1112	62.9	.91	94.8	1.01	194.2	1.03	435.5	1.06
	W.R.S. 1113	177.9	.66	311.5	.78	716.4	.79	1,600.4	.80
	Basin Total	240.8	.80	406.3	.72	910.6	.83	2,035.9	.84

* Millions of 1967 Dollars.

(D)- Information withheld to avoid disclosure.

Source: 1972 OBERS.

Table 10
1974 OBERS Projections of Earnings by Industry
Red River Above Denison Dam Study Area
1967-2020

Industry		Year							
		1967		1980		2000		2020	
		Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.
Total Earnings	W.R.S. 1112	476.8	1.00	571.1	1.00	935.2	1.00	1522.5	1.00
	W.R.S. 1113	1590.2	1.00	2178.8	1.00	4003.8	1.00	7069.8	1.00
	Basin Total	2067.0	1.00	2749.9	1.00	4939.0	1.00	8592.3	1.00
Farm	W.R.S. 1112	52.3	3.14	48.5	3.40	59.9	4.19	74.4	4.56
	W.R.S. 1113	190.2	3.94	217.3	3.99	259.8	4.24	330.6	4.37
	Basin Total	242.5	3.36	265.8	3.87	319.7	4.23	405.0	4.41
Government	W.R.S. 1112	131.1	1.66	97.1	.97	169.4	.96	288.9	.95
	W.R.S. 1113	555.0	2.48	683.0	1.79	1284.2	1.69	2318.2	1.64
	Basin Total	686.1	2.00	780.1	1.60	1453.6	1.55	2607.1	1.52
Manufacturing	W.R.S. 1112	34.1	.24	65.9	.44	110.2	.51	175.1	.54
	W.R.S. 1113	(D)	(D)	310.8	.54	618.6	.66	1084.2	.72
	Basin Total	181.9	.30	376.7	.52	728.8	.63	1259.3	.69
Mining	W.R.S. 1112	(D)	(D)	9.6	2.16	9.8	2.05	11.2	1.99
	W.R.S. 1113	(D)	(D)	61.5	3.62	61.3	2.88	69.9	2.67
	Basin Total	90.3	4.12	71.1	3.31	71.1	2.72	81.1	2.55
Contract Constr.	W.R.S. 1112	25.0	.89	30.3	.86	46.6	.85	72.0	.86
	W.R.S. 1113	57.5	.50	90.1	.67	170.0	.72	298.5	.76
	Basin Total	82.5	.67	120.4	.71	216.6	.75	370.5	.78

(Continued)

Table 10
1974 OBERS Projections of Earnings by Industry
Red River Above Denison Dam Study Area
1967-2020

Industry		Year							
		1967		1980		2000		2020	
		Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.	Earnings*	L.Q.
Transportation, Comm. & Utilities	W.R.S. 1112	42.7	1.29	58.1	1.45	90.5	1.42	140.8	1.38
	W.R.S. 1113	82.2	.61	117.5	.77	223.1	.82	399.2	.85
	Basin Total	124.9	.89	175.6	.91	313.6	.93	540.0	.94
Wholesale & Retail	W.R.S. 1112	93.4	1.18	122.1	1.37	174.6	1.27	255.3	1.23
	W.R.S. 1113	225.4	.75	309.9	.89	523.1	.89	850.3	.88
	Basin Total	318.8	.93	432.0	.98	697.7	.96	1105.6	.94
Finance, Insurance & Real Estate	W.R.S. 1112	24.0	.98	32.2	.97	60.0	.99	103.9	1.00
	W.R.S. 1113	49.3	.52	79.2	.63	165.7	.64	309.7	.64
	Basin Total	73.3	.69	111.4	.70	225.7	.71	413.6	.71
Services	W.R.S. 1112	62.9	.91	106.8	1.04	213.7	1.05	400.4	1.07
	W.R.S. 1113	177.9	.66	308.9	.79	697.6	.80	1408.8	.81
	Basin Total	240.8	.80	415.7	.84	911.3	.85	1809.2	.86

*Millions of 1967 Dollars.

(D) - Information withheld to avoid disclosure.

The basic difference between the two sets of OBERS projections is that the 1972 series is based upon a national birth rate of 2.78 births per woman while the 1974 series is based upon a corresponding birth rate of 2.11 births per woman. The lower birth rate results in a lower level of projected aggregate demand nationally and thus lower projected activity levels within the basin. The two series also differ in that the most recent OBERS studies incorporate data which were not available in 1972. Both series are expressed in constant dollars so as to reflect only changes in the physical level of activity and not price variations.

The complementary manner in which factor inputs combine to form outputs reduces the possible scale of activity in a region to the capacity of the input in shortest supply. Factor substitution and technological advance ease such restraints but only within limits. The methodology of the OBERS studies is such that regional activity is projected with emphasis on the demand for output rather than the supply of inputs. This is especially true with respect to labor. Thus, a good first check of the reasonableness of these projections for a basin is the projection of regional labor supply and a comparison of the results with the regional labor requirements implicit in the OBERS projections.

Population and Employment Projections

Table 11 depicts projections of employment and population for the Red River Above Denison Dam Study Area as published in the 1972 and 1974 OBERS reports. These projections are derived from national projections. The methodology for the OBERS regional projections is to project employment and then to project population on the basis of employment. The effect of

this methodology is to determine the population of a region as a function of the demand for labor in that region. Although such an approach is conventionally acceptable, it is not without its defects. These defects relate to evidence suggesting that economic growth is fastest in areas having considerable excess labor supply.[2/] This evidence suggests that the future scale of activity in a river basin may be influenced as much or more by the basin's supply of labor as well as its demand for it. As the issue of whether regional growth is demand or supply determined has not yet been resolved, it seems reasonable to project basin population and employment from the other side of the coin.

Tables 12 and 13 give projections of population and employment for the basin from a labor supply orientation. Each table contains three separate projections based upon varying birth rates. These projections were developed using the cohort survival method of population projection. The essence of this procedure is to begin with the current (1970 in this case) age-sex distribution of the population and to statistically adjust it over time for each of the components of population changes. The components of population change are births, deaths and net migration. The birth rates used to develop each projection series are given with the series. These rates are stated in terms of the number of children expected to be born to each woman of child-bearing age. The impact of deaths was incorporated into the projections through the use of projected five-year survival rates by age and sex.[3/] Net migration consists of the

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2/ See G. H. Borts and J. L. Stein, Economic Growth In A Free Market (New York: Columbia University Press, 1964).

3/ U. S. Department of Commerce, Bureau of the Census, Current Population Reports, "Population Estimates and Projections", Series P-25.

Table 11
Projected Employment Necessary to Support OBERS Activity Levels
Red River Basin Above Denison Dam
1980-2020

		Year		
		1980	2000	2020
1972 OBERS				
Employment	W.R.S. 1112	76,500	81,400	96,900
	W.R.S. 1113	334,300	380,300	444,400
	Basin Total	410,800	461,700	541,300
Employment/Population Ratio	W.R.S. 1112	.44	.42	.41
	W.R.S. 1113	.42	.42	.42
Population	W.R.S. 1112	175,700	192,200	234,900
	W.R.S. 1113	788,700	900,400	1,058,400
	Basin Total	964,400	1,092,600	1,293,300
1974 OBERS				
Employment	W.R.S. 1112	75,100	74,400	72,600
	W.R.S. 1113	310,300	341,200	356,700
	Basin Total	385,400	415,600	429,300
Employment/Population Ratio	W.R.S. 1112	.43	.44	.44
	W.R.S. 1113	.42	.44	.43
	Basin Total	.42	.44	.44
Population	W.R.S. 1112	173,100	167,300	165,400
	W.R.S. 1113	741,100	777,900	820,900
	Basin Total	914,200	945,200	986,300

Source: 1972 and 1974 OBERS.

Table 12
Projected Population Using Labor Supply Orientation
Red River ABove Denison Dam Study Area
1970-2020

Projection & Assumptions		Year			
		1970*	1980	2000	2020
		Population			
I. Birth Rate = 2.77, Net Migration = 0.0	W.R.S. 1112	173,768	195,200	246,000	300,200
	W.R.S. 1113	769,570	819,700	969,700	1,115,100
	Basin Total	943,338	1,014,900	1,215,700	1,459,300
II. Birth Rate = 2.30, Net Migration = 0.0	W.R.S. 1112	173,768	189,400	223,900	248,000
	W.R.S. 1113	769,570	795,700	883,400	963,700
	Basin Total	943,338	985,100	1,107,300	1,211,700
III. Birth Rate = 2.11, Net Migration = 0.0	W.R.S. 1112	173,768	186,600	213,600	228,200
	W.R.S. 1113	769,570	786,000	848,800	889,200
	Basin Total	943,338	972,600	1,062,400	1,117,400

* Actual

Table 13
Projected Employment Using Supply Orientation
Red River Above Denison Dam Study Area
1970-2020

Projections & Assumptions		Year 1970*	1980	2000	2020
	1972 OBERS Conditions[1/]				
I. Birth Rate = 2.77, Net Migration = 0.0	W.R.S. 1112	71,473	85,900	103,300	123,900
	W.R.S. 1113	333,882	344,300	407,300	468,300
	Bas n Total	405,355	430,200	510,600	592,200
II. Birth Rate = 2.30, Net Migration = 0.0	W.R.S. 1112	71,473	83,300	94,000	101,700
	W.R.S. 1113	333,882	334,200	371,000	404,800
	Basin Total	405,355	417,500	465,000	506,500
III. Birth Rate = 2.11, Net Migration = 0.0	W.R.S. 1112	71,473	82,100	89,700	93,600
	W.R.S. 1113	333,882	330,100	356,500	373,500
	Basin Total	405,355	412,200	446,200	467,100
	1974 OBERS Conditions[1/]				
I. Birth Rate - 2.77, Net Migration = 0.0	W.R.S. 1112	71,473	83,900	108,200	132,000
	W.R.S. 1113	333,882	344,300	426,700	498,400
	Basin Total	405,355	428,200	534,900	630,400
II. Birth Rate - 2.30, Net Migration = 0.0	W.R.S. 1112	71,473	81,400	98,500	109,100
	W.R.S. 1113	333,882	334,200	388,700	414,400
	Basin Total	405,355	415,600	487,200	533,500
III. Birth Rate - 2.11, Net Migration = 0.0	W.R.S. 1112	71,473	80,200	94,000	100,400
	W.R.S. 1113	333,882	330,100	373,500	382,400
	Basin Total	405,355	410,300	467,500	482,800

* Actual

1/ The 1974 OBERS conditions incorporate data from the 1970 Census into the projections. The most recent observations incorporated into the 1972 OBERS projections were from the 1960 Census. These differences coupled with the differences in the assumed birth rates result in the divergences between the projection series.

number of in-migrants into the basin less the number of out-migrants expressed as a percent of the population at the beginning of the period in question. For reasons given below, the net migration rate was assumed to be 0.0 for all three series.

Both the 1972 and 1974 OBERS projections of population for the basin implicitly involve substantial out-migration. This condition may be detected by comparing the results of the labor supply oriented projections using the 2.77 and 2.11 birth rates with the 1972 and 1974 OBERS projections. The birth rates of these supply oriented projections are the same as those in the respective OBERS studies. All series are computed using the same set of projected survival rates, leaving the only difference in the projections based on the same birth rate being net migration and its cumulative effects.

The net migration from the basin implicit in OBERS is substantial for both the 1972 and 1974 studies although more severe in the latter set of projections. The net out-migration from the basin implicit in the 1972 OBERS from 1970 to 1980 is 50,500 persons. The corresponding figure for the 1974 OBERS studies is 58,400 persons. The severity of the latter figure can be appreciated when one considers that this series is based upon a substantially lower birth rate than the 1972 OBERS projections.

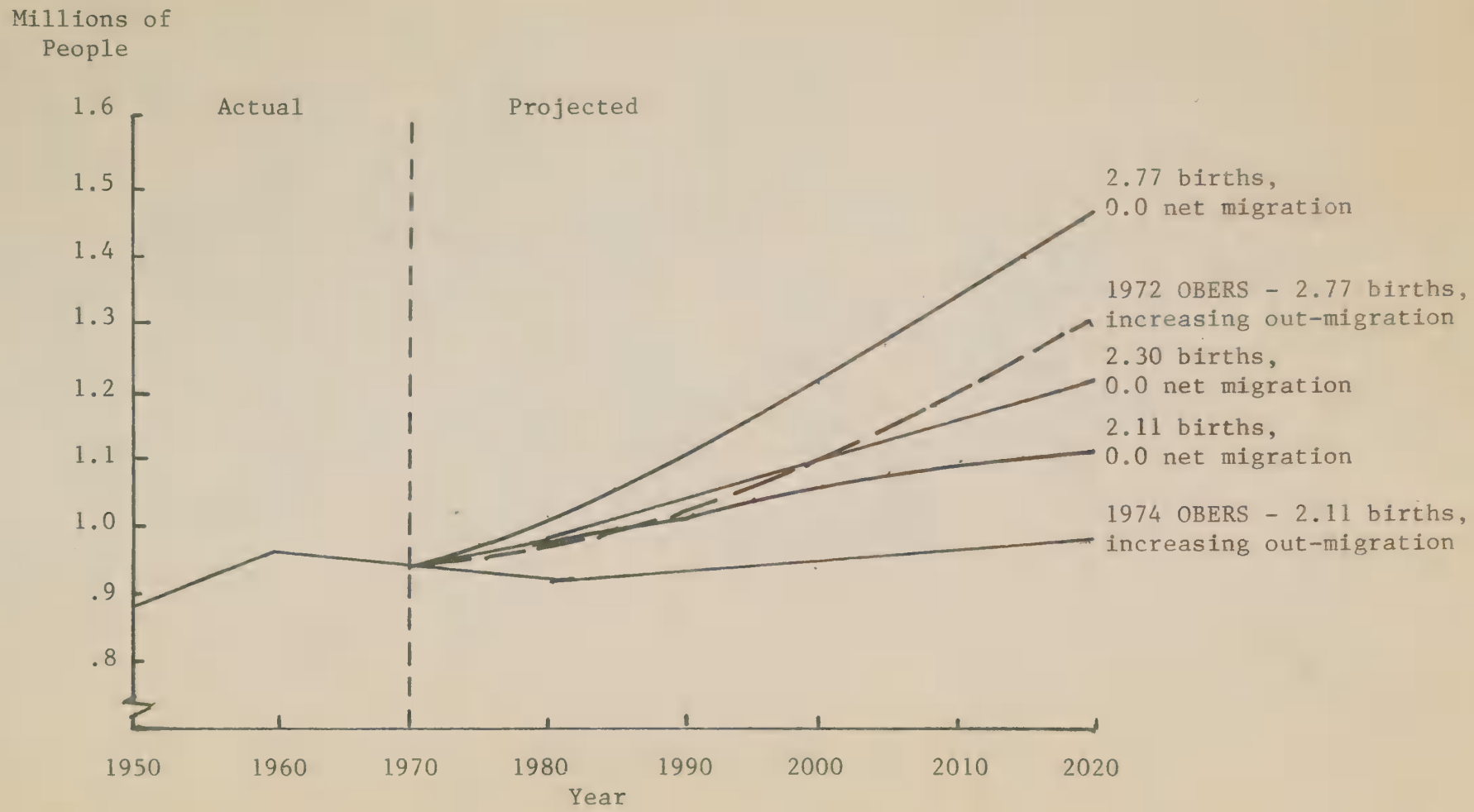
The exact scale of net out-migration from the basin implicit in the OBERS studies cannot be measured accurately beyond 1980. This is due to the cumulative effects of migration on total population. The impact of migration on total population is not limited to those who migrate but extends to the other sources of population change (birth and death) by

altering the potential number of people who may experience them. Recognizing this, it can be noted that the difference between the 1972 OBERS projected basin population for the year 2000 and the corresponding supply oriented projection with no net out-migration is 123,100. The corresponding figure for the 1974 OBERS projection and its supply oriented counterpart is 117,200. The latter figure represents a more severe rate of net out-migration as it is derived from a smaller base population (914,344) than the former (964,400). The corresponding figures for the year 2020 are 166,000 for the 1972 OBERS projection and 131,000 for the 1974 OBERS study.

The effect upon the population of the basin of varying birth and migration rates can be appreciated via a visual presentation of the population projections given in Table 12. Such a presentation is made in Figure 2. This illustration depicts graphically the OBERS and labor supply oriented projections which have been under discussion to this point. With the aid of the graph, an assessment of which of the projections is most acceptable will now be made.

The 1972 OBERS projection and the projection based upon a 2.77 birth rate and 0.0 net migration rate are both outdated. These projections are based upon a birth rate which was last experienced in this country in the late 1960's. This fertility rate is lower than that experienced in the early 1960's but substantially above that which has been experienced recently. In light of this, it is highly doubtful that the actual future course of the basin's population will approximate either the 1972 OBERS projection or the alternative projection based upon the same birth rate and zero net migration.

Figure 2
Alternative Population Futures
Red River Above Denison Dam Study Area
1950-2020



A third projection depicted in Figure 2 assumes a birth rate of 2.30 births per woman and zero net migration. This projection results in projected basin populations which are greater than the 1972 OBERS projections through the year 2005. In spite of the lower fertility rate assumed by this series, its assumption of zero net migration keeps it above the 1972 OBERS level until that point in time. Although the 2.30 birth rate is substantially less than that which ensued during the 1950's and 1960's, it is considerably higher than current fertility rates. On the basis of this consideration, the projection based upon a 2.30 birth rate and zero net migration is probably high for the basin throughout the projection period.

The projections based upon a birth rate of 2.11 are the most consistent with recent fertility experience of all population projections discussed in this report. This fact makes these projections the most acceptable for use in this study. Given this, what remains is to ascertain the probably future course of net migration within the basin. Some help in this may be found by reviewing the actual behavior of net migration from the basin over the last two decades.

For the entire basin, net migration from 1950's to 1960 was -50,323 persons. This total includes a net migration figure of -90,093 for W.R.S. 1113 and of +39,770 for W.R.S. 1112. The latter figure reflects a substantial increase in military personnel in W.R.S. 1112 over the decade in question. Within W.R.S. 1113, the net migration figures for the same decade are -41,764 for the Oklahoma portion and -48,329 for the Texas portion of the subarea.

Net migration from the basin was -112,680 over the decade from 1960 to 1970. The most striking difference in the basin's migration pattern

between this and the previous decade was the net out-migration of 29,620 people from W.R.S. 1112. The net out-migration from W.R.S. 1113 was less than in the previous decade (34,842) on the Texas side of the subarea but was more pronounced (48,218) on the Oklahoma side. The reversal of the migration pattern in W.R.S. 1112 was primarily due to a phasing down of military activity which had been built-up in the previous decade.

If the future were merely a linear extension of the past, one could expect continued substantial net out-migration from the basin. Trends ofter reverse themselves, however, rendering projections based purely on past trends useless. There is evidence to suggest that the severity of the net out-migration experienced by many rural areas has lessened. In some rural areas, net out-migration has been reversed. Within the basin itself, recent estimates of population and the components of its change since 1970 suggest a considerable change in migration patterns. These estimates[4/] pertain to the Oklahoma portion of the basin and include a net migration figure of -2,200 over the three years since 1970. On a decennial basis, net out-migration from the Oklahoma portion of the basin would equal 7,330 at this rate. This figure is considerably below the net out-migration of 48,128 experienced by the same area from 1960 to 1970. Although these figures are estimates, they are based upon acceptable procedures which reflect demographic trends with considerable reliability. These trends suggest a marked decline in the rate of net out-migration from the basin.

The decline in net out-migration indicated by the Oklahoma projections suggests that the 1974 OBERS projections of basin population

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4/ U. S. Department of Commerce, Bureau of the Census, Current Population Reports, "Estimates of the Population of Oklahoma Counties and Metropolitan Areas: July 1, 1972 and 1973", Series P-26, No. 63.

are low. The continued existence of net out-migration, however, suggests that the projection series assuming a 2.11 birth rate and zero net migration is high. It is probable at this point in time, that the actual future course of the basin's population will fall within the range established by these two series. On this basis, it seems reasonable to adopt the 1974 OBERS projection of basin population as a low projection and the labor supply oriented series assuming a 2.11 birth rate and zero net migration as a high projection.

Having adopted upper and lower limit projections of basin population, the probable range of future basin employment levels can now be set forth. The limits of this range are given in Tables 11 and 13. For 1980 the projected range of total basin employment is between 385,400 and 410,300. For the year 2000, the range of projected employment is between 415,600 and 467,500. The projected range of basin employment in 2020 is from 429,300 to 482,800.

Earnings Projections

Throughout this report, earnings have been used as a measure of economic activity within the study area. Projected levels of earnings by industry can be developed consistent with the projections of population and employment developed in the previous section. Such projections are given in this section for the high and low population and employment series. The earnings projections are expressed in terms of constant (1967) dollars. Such expression limits projected changes to those involving the physical level of output.

Table 14 depicts the projections of basin earnings by industry to 2020 for both the high and low series. Earnings projections are also

Table 14
Projected Range of Earnings by Industry
Red River Above Denison Dam Study Area
1967-2020

Industry	1967	1980				2000				2020			
		Low		High		Low		High		Low		High	
		Earnings*	% of 1967	Earnings*	% of 1967	Earnings*	% of 1967	Earnings*	% of 1967	Earnings*	% of 1967	Earnings*	% of 1967
Total Earnings	2067.0	2749.9	133	2913.8	141	4939.2	239	5554.8	269	8592.3	416	9846.8	476
Farm	242.5	266.0	110	281.8	116	320.0	132	360.0	148	405.0	167	464.2	191
Government	686.1	780.2	114	826.6	120	1453.7	212	1634.8	238	2607.1	380	2987.7	435
Manufacturing	181.9	376.8	207	399.2	219	728.9	401	819.9	451	1259.3	692	1443.2	793
Mining	90.3	71.2	79	75.5	84	71.1	79	80.0	89	81.1	90	93.0	103
Contract Con.	82.5	120.6	146	127.9	155	216.8	263	243.9	296	370.5	449	424.9	515
Trans., Comm. & Pub. Util.	124.9	175.7	141	186.2	149	313.7	251	352.7	282	540.0	432	618.9	496
Wholesale & Retail Trade	318.8	432.2	136	458.0	144	697.8	219	784.9	246	1105.6	347	1267.1	397
Finance, Ins. & Real Est.	73.3	111.5	152	118.0	161	225.7	308	253.9	346	413.6	564	474.1	647
Services	240.8	415.8	173	440.6	183	911.4	378	1024.9	426	1809.2	751	2073.4	861

* Millions of 1967 dollars.

Source: 1974 OBERS

expressed as a percent of the 1967 level of earnings as a means of gauging the scale of the projected activity level relative to a base point in time. In a strictly limited sense, the earnings relatives may be interpreted as proxies of future levels of resource demand by industry. The factors which limit such an interpretation are the assumptions of zero technical progress and zero factor substitution. The relaxation of these assumptions has the effect of lowering future levels of resource demand. As both technical progress and factor substitution occur at above-zero levels, the earnings relatives represent higher levels of resource demand than can realistically be expected to occur at these activity levels. In applying them to resource problems, they should be adjusted appropriately for this shortcoming.

Projected Export Earnings in Relation to Total Earnings

The projected relationship between export activity and total economic activity in the basin may be estimated by the same procedure as was used to gauge this relationship historically. This relationship has been estimated using the location quotients implicit in the 1974 OBERS projections of basin earnings by industry. The estimates appear in Table 15.

The basin's projected export base contains essentially the same industries as it has in the past. These industries are agriculture, government and mining. Export earnings from agriculture are projected to increase to a range of $196.2 - $207.8 million by 1980. This level of agricultural export earnings is above the estimated 1971 level but is subtantially below the $234.5 million level estimated for 1970. Additional increases in agricultural export earnings are projected for 2000 and 2020.

Table 15
Projected Estimates of Earnings Due to Export Activities
Red River Above Denison Dam Study Area
1967-2020

Industry	1967	1980		2000		2020	
		Low	High	Low	High	Low	High
	Millions of 1967 Dollars						
Farm	169.8	196.2	207.8	242.9	273.2	313.1	358.8
Government	362.5	298.6	316.3	515.8	580.0	891.6	1,021.8
Mining	68.7	49.8	52.8	45.9	51.6	49.3	56.5
Total Export Earnings	601.0	544.6	576.9	804.6	904.8	1,254.0	1,437.1
Total Basin Earnings	2,067.0	2,749.9	2,913.8	4,939.2	5,554.8	8,592.3	9,846.8
Export Earnings as a Percent of Total Earnings	29	20	20	16	16	15	15

The projected range of agricultural export earnings for the year 2000 is from $242.9 to $273.2 million. The corresponding range for 2020 is from $313.1 to $358.8 million.

Export earnings from governmental activity are also expected to increase over the projection period. As with agriculture, however, the projected range of basin export earnings derived from government activity is projected to be lower in 1980 than in its peak years during the 1960's. The projected range of basin export earnings from government activity for 1980 is from $298.6 to $316.3 million. This range is projected to rise to $515.8 - $580.0 million by the year 2000 and to $891.6 - $1021.8 million by 2020.

Earnings derived from mining activity within the basin are projected to remain below their peak 1967 levels throughout the projection period. The projected range of the basin's export earnings from mining activity is from $49.8 to $52.8 million for 1980. For the year 2000, it is from $45.9 to $51.6 million and for 2020, it is from $49.3 to $56.5 million.

The decline in the ratio of the basin's export earnings to its total earnings is expected to continue into the projection period. This indicates that the development of the basin's residentiary sector is expected to continue. As was noted earlier, the effect of this development is to enlarge the superstructure of the basin economy relative to its foundation.

Economic Problems In The Basin

Economic problems generally manifest themselves as poor levels of living. Low levels of living can be detected in general by a comparison of per capita incomes in the basin with their national counterparts.

Specific inadequacies can be detected through a review of housing characteristics and their comparison with appropriate national figures.

The causal elements of economic problems are to be kept distinct from the manner in which they manifest themselves. The basic causes of economic problems are much more difficult to identify than the problems themselves. Substandard living conditions may result from an imbalance of capital relative to labor, from an inadequate supply of human capital, or from a host of other factors which prevent an efficient combination of productive factors or which impede the operation of the market mechanism. Although it is beyond the scope of an economic base study to probe in depth the causes of the basin's economic problems, it is appropriate to call attention to the factors which bear upon them.

Table 16 traces per capita income in the basin from 1950 to 1971 as measured in current dollars. The lower half of the table depicts the same figures expressed as a percent of the appropriate national per capita income figures. As the table indicates, the per capita income of the entire basin has remained consistently below the national level throughout the period covered. Although an upward trend was evident in the entire basin's per capita income relative from 1950 to 1967, this trend evaporates for the period from 1967 to 1971. The evaporation correlates closely in time with the phasing down of military activity in the basin suggesting that this activity tended to support rather than retard income levels in the basin. The basin's per capita income relative was only one point higher in 1971 than it was two decades earlier.

Per capita incomes have tended to vary considerably within the basin. In 1950, for example, per capita income in W.R.S 1112 was 133

Table 16
Per Capita Total Personal Income
Red River Above Denison Dam Study Area
1950-1971

	1950	1959	1962	1965	1966	1967	1968	1969	1970	1971
					Current Dollars					
W.R.S. 1112	1,987	2,326	2,446	2,694	3,145	3,186	2,959	3,118	3,755	3,886
W.R.S. 1113	1,198	1,758	1,877	2,288	2,501	2,704	2,924	3,209	3,458	3,558
Texas Portion	1,465	1,877	2,075	2,448	2,738	2,885	3,199	3,479	3,682	3,805
Oklahoma Portion	981	1,664	1,724	2,166	2,320	2,573	2,724	3,007	3,286	3,363
Basin Total	1,293	1,860	1,983	2,369	2,631	2,799	2,931	3,192	3,513	3,619
					Percent of National Average					
W.R.S. 1112	133	108	103	97	106	101	86	84	95	93
W.R.S. 1113	80	81	79	83	84	85	85	87	88	86
Texas Portion	98	87	88	89	92	91	93	94	94	92
Oklahoma Portion	66	77	73	78	78	81	79	81	84	81
Basin Total	86	86	84	86	89	88	85	86	89	87

Source: Regional Economics Information System, Bureau of Economic Analysis.

percent of the national level. At the same time, per capita income in the Oklahoma portion of W.R.S. 1113 was only 66 percent of the national level. Over time, the disparity of per capita incomes among subareas within the basin has tended to decline. The per capita income relative of W.R.S. 1112 declined to 93 by 1971 while that of the Oklahoma portion of W.R.S. 1113 rose to 81. These subareas remain the extremes of per capita incomes among subareas in the basin.

The income figures presented and discussed above are not adjusted for geographic variations in the cost of living. Indices of spatial variations in the price level are not available for nonmetropolitan areas at this time. However, it is possible to observe such variations in specific items. Housing, for example, constitutes a major portion of most consumer budgets. Estimates are available for the median contract of housing units having all plumbing facilities. In 1970 the median contract rent of such units in the study area was approximately $54. The corresponding figure for the entire United States was $89. Given that the median rent level in the basin is only 61 percent of the national figure, one is tempted to conclude that basin residents may live at higher levels of comfort than the national average simply by virtue of having a lower price level to cope with.

Such a conclusion would be a hasty one, however, and is probably not borne out in fact. It is conceivable that the only feature common to the houses being compared in the rent figures is that they have adequate plumbing facilities. No allowance is made in the rent values, for example,

for variations in the age of the structures or their state of repair. In addition, the rent figures are exclusive of units lacking some or all plumbing facilities. Within the basin's rural housing inventory, as many as 12.2% of the occupied units fall into this category. This figure applies to the Texas portion of W.R.S. 1113. For the entire basin, the corresponding figure is 10.1%. Nationally, about 5.5% of all occupied housing units lack some or all plumbing facilities. Figures such as these rather severely discount the naive comparison on median rent levels in the basin with their national counterparts.

From a resource economist's perspective, it is tempting to conclude that the basin's low per capita income level is solely due to an imbalance of human and capital resources. Such an imbalance might take the form of a shortage of capital relative to human resources. A shortage of this type would depress income levels by holding down the marginal product of labor. Assuming that the wage rate is determined by the marginal product of labor, the low wage rate and a good share of the low incomes could be explained in terms of the shortage of capital. The conclusion to be drawn from this line of thought is that the basin's low income level could be raised by increasing the basin's capital stock.

A cursory review of labor statistics pertinent to the basin reveals evidence which both supports and detracts from the theoretical capital shortage argument. The basin's unemployment rate was 3.9 percent in 1970. The range of 1970 unemployment rates among subareas in the basin was from 3.3 to 4.6 percent with the low and high rates applying to the Texas and Oklahoma portions of W.R.S. 1113. These low rates suggest that the basin's labor market operates rather well with only a small portion of those willing, able and actively seeking work not finding it.

Unemployment statistics are far from perfect measures of labor market conditions. A specific weakness of these statistics is that they do not consider underemployment. Underemployment exists when labor is not employed to its full potential. A factory worker, working twenty hours per week is underemployed. A highly educated individual working as a laborer is also underemployed. In the first case, the underemployment is due to working less than the normal forty hour week. In the second case, underemployment is due to the wasting of a large quantity of investment in education by applying it to a menial job. In each case, both the underemployed individuals and society suffer. The individual suffers from reduced income levels. Society suffers from a level of output which falls considerably short of its potential.

Estimates of underemployment are not readily available on a current basis. Those which are available, however, indicate that underemployment is a much more serious problem in the basin than is unemployment. It has been estimated that, in 1960, some 26.3 percent of the basin's male labor force and 30.7 percent of the female labor force was underemployed. Measured in absolute terms, this amounts to approximately 64,199 man-years of unutilized labor. On a county-by-county basis, this is equivalent to an average of 26.5 percent of the potential of employed persons being lost to underemployment. Unemployment rates among basin counties averaged 3.9 percent in the same year.

The unemployment statistics given above do not support the resource imbalance thesis. The underemployment figures, however, suggest that such a problem may exist in the basin. Other factors may also exist which could cause incomes in the basin to be lower than the national level. Among these factors is the basin's stock of human capital.

Human capital consists of the productive skills, talents, and knowledge of individuals. An individual's stock of human capital influences the level of his income. The stock of human capital in a region influences the level of income in that region. Human capital cannot be measured precisely at the individual, regional or national level. It can, however, be estimated through the use of proxy variables. Two such proxies are measures of education levels and the average age of the population. Although these proxies are not perfect measures of human capital, they do reveal some of its important characteristics.

Education levels are generally measured by the median number of school years completed by persons over twenty-five years of age. In the United States, for example, the median education level among people in this bracket was 12.1 years as recorded in the 1970 Census of Population. The corresponding figure for the basin is 10.9 years or about 90 percent of the national level.

Statistics on age are also approximate measures of human capital. As we are relating human capital to per capita income, the median age of the total population is an appropriate measure. In the entire United States, the median age in 1970 was 28.3. The corresponding figure for the basin was 36.1 years or about 28 percent higher than the national figure.

The proxy measures of the basin's stock of human capital shed some light on its income situation. The effect of its having an average education level which is 90 percent of the national level suggest that at least a portion of its low income problems are related to a shortage of human rather than physical capital. The substantially higher average age of the basin population relative to that of the entire nation can be expected

to affect incomes in the same manner. Associated with high average age is a larger than normal proportion of persons of retirement age. Given this, one would expect a larger than normal proportion of the basin's population to be of retirement age, thus causing its per capita productive potential and its per capita income level to be lower than the national average.

Apart from the level of per capita income, economic problems may manifest themselves in the form of skewed income distribution. Income distribution problems arise when a large portion of total income accrues to a few and a small proportion accrues to many. Income distribution problems are not revealed by per capita income figures. They can be detected, however, by other means. Among these means is the Gini ratio, or index of income concentration, and the Lorenz curve.

The distribution of income by quintile of households and unrelated individuals in the basin is given in Table 17. This table depicts the percent of total income which accrued to basin families by quintile in 1970. Each quintile represents a twenty percent segment of all families as they fall on a continuum ranging from those with the lowest to those with the highest incomes.

A quick perusal of Table 17 suggests that income distribution may be a problem in the basin. Reflection on the subject, however, qualifies this suggestion. Few would argue that incomes should be distributed equally. The issue thus revolves around the extent of income inequality. In general, the extent of income inequality in the basin is less than in the states of Texas and Oklahoma and is approximately equal to that in the entire United States.

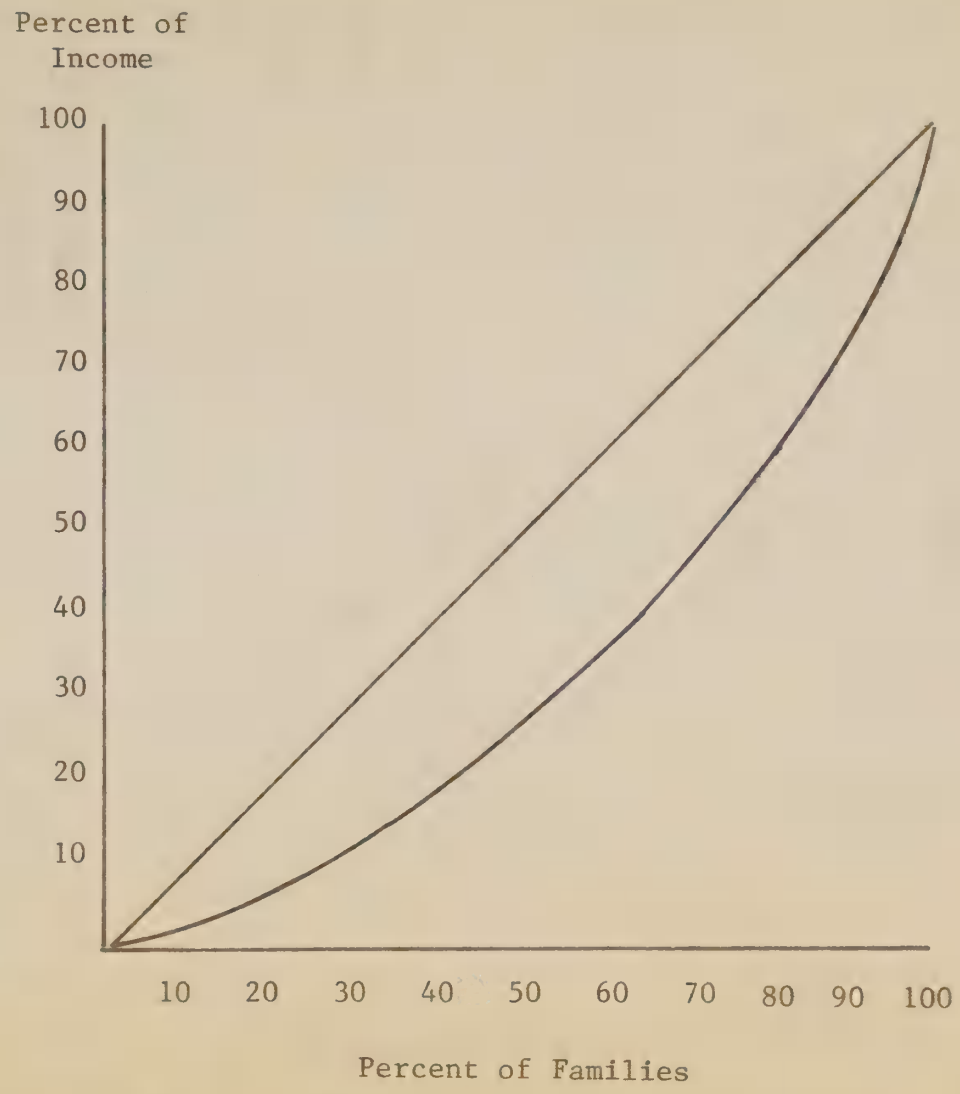
Table 17
Estimated Distribution of Income by Class
Red River Above Denison Dam Study Area, 1970

Income Class	Percent of Income
Lowest quintile	5.5
Second quintile	11.5
Third quintile	16.0
Fourth quintile	25.0
Fifth quintile	42.0

The Gini ratio is an index of income inequality ranging from zero to one. A score on this index of zero represents complete equality; a score of 1.0 represents the greatest possible inequality. The Gini index for the Red River Above Denison Dam is estimated to be .365. The index for Texas is .380, for Oklahoma .510, and for the entire United States .364. These index values suggest that the basin's income distribution is more equal than that of either of its parent states and is only slightly more unequal than that of the entire United States. Income distribution is considered to be a problem nationally, however. On this basis, it must be concluded that income distribution is a problem within the basin although less severe than in all of Oklahoma and Texas.

A weakness of the Gini index is that it does not distinguish the income level or levels at which income inequality exists. The Lorenz curve may be utilized to correct this weakness at least in part. Such a curve is given for the basin in Figure 3. The Lorenz curve depicts graphically essentially the same information as the Gini index. In the

Figure 3.
Lorenz Curve Portrayal of Income Distribution
Red River Basin Above Denison Dam Study Area



illustration, the diagonal line is analogous to a Gini index value of zero. The curved line depicts the distribution of income in the basin. The Gini index measures the extent of income inequality for the average point along the curve. The slope of the curve, however, varies from point to point along the curve. This variation indicates that the degree of income inequality is not the same at all income levels. Where the slope of the curve (rise over run) is least, the extent of income inequality is greater. From the illustration, it can be seen that the extent of income inequality in the basin is greatest at the low income levels. This condition aggravates the general income distribution problem although it is not revealed by the Gini index.

Resource Development Impact Measures

As used here, impact refers to the total effect upon the basin economy of an autonomous change in an economic variable. Autonomous refers to those changes which are imposed upon the basin's economic system from the outside. Federal programs of resource development are autonomous to the basin economy. They have the effect of jolting the basin economy from one aggregate equilibrium position to another. The transition comes about as a result of the change in the quantity of inputs which make their way through the basin economic system as they become part of its output. A portion of this shift in the scale of economic activity owes directly to the autonomous changes itself. A second part, however, is only indirectly tied to the autonomous change. The objective of impact analysis is to estimate the total economic consequence, direct and indirect, of an autonomous change in an economic variable.

The direct effects of resource development are unique to each project. They cannot be estimated prior to the specific delineation of proposed projects. Indirect effects, however, are not unique to individual projects. Rather, they are more general effects which owe their existence to the internal operation of the basin economy. Indirect effects are a form of pecuniary external economy. Pecuniary external economics owe their being to the interdependence of economic units. This interdependence, in turn, stems from the existence of the market mechanism upon which the private sector depends for resource allocation. Indirect effects are called externalities because neither their costs nor their benefits can be allocated to specific producers or consumers. Externalities are similar to social goods in that both their costs and their benefits are born by society as a whole.

USDA Procedures For Planning Water and Related Land Resources (3-74) state that pecuniary externalities will be estimated from existing input-output studies until multipliers appropriate to specific planning studies are developed by the Water Resources Council. The multiplier is a device measuring the total expected change in an economic variable which can be expected to result from a given autonomous change in that variable. Multipliers derived by input-output procedures account not only for the interdependence among economic units due to money flows but also for technical linkages among industries implicit in the production process. As multipliers derived by the input-output procedure are the only ones which account for both types of linkage, they are considered superior to those derived by other methods.

A rather extensive input-output study was completed for the Texas High Plains area in August, 1972. The data and results of this study

pertain to 1967. Although the Texas High Plains area is not perfectly congruent with the area of study, there is considerable overlap between the two. The basin economy probably has more in common with the economy of the Texas High Plains than any other area for which input-output studies are available. For this reason, multiplier values available from the Texas High Plains study possibly could be used to estimate the indirect effects of resource development projects in Red River Basin Above Denison Dam.

Table 18 gives multiplier values for thirteen industries as published in the Texas High Plains report. Each of these multipliers include direct, indirect and induced effects. Induced effects are a component of the general indirect effects. They represent the externalities implicit in the operation of the market mechanism which owe their being to household's earning incomes in basin industries and spending a portion of their incomes on the outputs of those same industries. Eleven of the multipliers are for specific sectors of agriculture. The remaining two are for mining industries. They have been included as a means of comparing agricultural multipliers with those of the basin's only other private sector basic industry.

The multipliers given in Table 18 are income multipliers. Their application should be as follows. For a proposed project whose direct benefits are an increase in the production of irrigated cotton of $1,000, the total benefit is an increase of total basin income of approximately $2,950. This total is comprised of the $1,000 direct benefit and $1,950 indirect benefits. The indirect benefits could have been derived directly

Table 18
Multiplier Values, Direct, Indirect & Induced Effects
Selected Industries, Texas High Plains Region
1967

	Industry	Multiplier Value
	Agricultural	
1.	Irrigated Cotton	2.95
2.	Irrigated Food Grain	2.83
3.	Irrigated Feed Grain	2.84
4.	Other Irrigated Crops	2.82
5.	Dry Cotton	2.96
6.	Dry Food Grain	2.77
7.	Dry Feed Grain	2.79
8.	Other Dry Crops	2.92
9.	Range Livestock	2.74
10.	Feedlot Livestock	2.05
11.	Dairy & Poultry	3.05
	Mining	
12.	Crude Petroleum	2.10
13.	Natural Gas	2.56

Source: J. E. Osborn and W. C. McCray, The Structure of The Texas High Plains Economy, Dept. of Agricultural Economics, Texas Tech University, Lubbock, Texas, August, 1972, Appendix B, Table 3.

by multiplying the direct benefits by 1.95 (2.95 - 1.0). This procedure may be applied to all multipliers given in the table.

The multipliers given in Table 18 may be used to estimate adverse indirect effects as well as beneficial effects. This can be done by applying appropriate industry multipliers to the estimated adverse effects associated with a project. For example, suppose a given project will withdraw sufficient rangeland from productive use that total output of range livestock declines by $1,000. The total adverse effect is $2,740 ($1,000 x 2.74) with $1,740 of this total being indirect adverse effects.

The operation of the multiplier is not instantaneous but emerges only over time. For multipliers derived by input-output procedures, the amount of time necessary for the full operation of the multiplier is determined at least by the length of the production process (in terms of time) and by the rapidity with which expenditures are made out of income. Both of these time determinants are based upon the presumption that the regional supply of the factors of production can (and will) respond to the stimulus of the proposed resource development program. If, for any reason, such supply response is not forthcoming, the operation of the multiplier will be retarded and the estimated indirect benefits not realized in full.

The multipliers provided in Table 18 are static. They apply specifically to one point in time, 1967, and were developed on the basis of historical data. Their use in evaluating future projects is thus limited by the assumption of what was true of the past being true of the future. It has been noted in other sections of this report that the

proportion of the basin economy which is basic has been declining relative to its total dimensions. On the basis of this observation, one would expect the multiplier values of basic industries to increase. Any estimate of the magnitude of such an increase, however, would be highly speculative. It does seem acceptable, however, to note that such a change in the base ratio suggests that the direction of change in the multiplier values of the basin's basic industries has been upward rather than downward. The industry structure of the basin economy implicit in the OBERS studies indicates that this trend is projected to continue.

Summary and Conclusions

Agriculture, mining and federal govenment activities comprise the economic base of the Red River Above Denison Dam. Agriculture is basic to the economy of the entire basin and to all of its subareas. Federal government activities are basic to the region and to W.R.S. 1113 but are non-basic to W.R.S. 1112. Wholesale and retail trade, on the other hand, are basic to the economy of W.R.S. 1112 but not to W.R.S. 1113. Mining activity is probably basic to all subareas in the basin. A definitive classification of mining as a basic or service industry is not possible, however, due to disclosure problems.

Earnings generated by the export of basin outputs are estimated at $541.8 million for 1971. Export earnings comprised 22 percent of total basin earnings in that year, a proportion which has declined considerably from its peak of 29 percent in 1966-67. This decline probably reflects the increased development of the residentiary sector of the basin economy rather than a general lagged response in residentiary activities to a change in basic activities. Among private industries, agriculture is the most important source of export earnings. Earnings generated by the export of the basin's agricultural outputs were $189.4 million in 1971 and have been as high as $234.5 million. Earnings derived from the export of mineral outputs were $38.2 million in 1971, down substantially from previous years. Export earnings derived from federal government activities in the basin were $314.2 million in 1971, also down considerably from their peak levels.

Economic growth in the basin since 1940 has proceeded at a slower pace than growth in the national economy. The primary cause of the basin's slow growth experience has been its preponderance of slow growth industries, notably agriculture. From 1940 to 1960, the basin's share of national output increased. This increase partially allieviated the effects of the basin's slow growth industry mix. Since 1960, however, the basin's share of national output has declined.

Projections of economic activity in the basin indicate agriculture, mining and federal government activities will continue to comprise its economic base. Total export earnings are projected to approximately $1.3 billion by the year 2020. Total basin earnings are projected at roughly $9.2 billion in the same year. Export earnings are projected to comprise an increasingly smaller proportion of total basin earnings reflecting the continued development of the residentiary sector. The earnings projections correspond with a projected basin population of between 986,300 and 1,117,400 people in the year 2020.

The economic problems of the basin have manifested themselves as low incomes and low levels of living. Per capita incomes in the basin are low relative to the entire United States and on balance have shown little tendency for improvement over the past two decades. This problem is most evident in the Oklahoma portion of W.R.S. 1113. Although the income situation is less serious in W.R.S. 1112 than in other subareas of the basin, the income relative in that subarea has declined considerably. Underemployment appears to have played a larger causal role in the basin's low income situation than has unemployment. There

is evidence to suggest that some resource imbalance exists in the basin's economy. A shortage of human capital appears to play as large a role in this situation as does a shortage of physical capital. The extent of income inequality in the basin is less severe than in all of Texas or Oklahoma and is similar to that of the entire United States. Income inequality in the basin appears to be greatest at low income levels, however, a feature which aggravates the problem.

Should public investment be undertaken to develop the basin's water and related land resources, the resulting increase in output can be expected to shift the basin economy to a higher equilibrium level of aggregate income and expenditure. Detailed studies to derive estimates of the extent of such pecuniary externalities as they apply directly to the basin have not been undertaken. Existing studies of economies similar to that of the basin indicate that increased agricultural production has the effect of raising the equilibrium level of basin aggregate income by $2.86 for each dollar of increase in irrigated and dryland crop production and by $2.61 for livestock production. These multiplier values are static and apply directly to 1967. Such multiplier values may change over time and are not instantaneous in their realization. The amount of time necessary for their full operation is determined by the length of the production process as measured in time and by the rapidity with which expenditures are made out of income.